MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL A Constituent Institution of Manipal University

SENENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION NOV/DEC 2017 SUBJECT: NANO TECHNOLOGY (ECE -4029)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. Define (i) Crystalline material (ii) Lattice (iii) Basis (iv) Co-ordination number (v) Atomic Packing factor.
- 1B. Consider the schematic shown in **Figure 1B**. The nanoparticle has to be moved from position A to position B. It uses SPM probe to move the nanoparticle.
 - (i) Suggests the mechanisms and principle to do that.
 - (ii) Name the particular type of SPM.





1C. Difference between direct and indirect bandgap semiconductor.

(5+3+2)

(5+3+2)

- 2A. The width of an infinite potential well is 12 Å. Determine the first three allowed energy levels (in eV) for an electron. Repeat for a proton.
- 2B. Derive the DOS equation for 2D nanostructure and draw the same.
- 2C. Derive Hamiltonian expression for classical particle.

3A. (i) A particle is described by the wave function

$$\psi(x) = A * \cos\left(\frac{2\pi x}{L}\right)$$
 for $-L/4 \le x \le +L/4$,
= 0 otherwise

(a) Determine the normalization constant A. (b) What is the probability that the particle will be found between x = 0 and x = L/8 if its position is measured?

(ii) An electron having total energy E = 4.50 eV approaches a rectangular energy barrier with U = 5.00 eV and L = 950 pm as. Classically, the electron cannot pass through the barrier because E < U. However, quantum-mechanically the probability of tunnelling is not zero. Calculate this probability, which is the transmission coefficient.

3B. Explain the concept of sensor using TFT.

ECE -4029

(6+4)

- 4A. Within a cubic unit cell, sketch the following: (i) [-2 1 2] (ii) [3 -1 2] (iii) [1 0 -2] (iv) (1 0 -1) (v) (3 -1 2).
- 4B. Explain the operation of SEM with neat diagram.

(5+5)

- 5A. Explain the fabrication step of MESFET with neat diagram.
- 5B. Explain synthesis of 1D nanowire using VLS process.
- 5C. Explain the concept of HOMO and LUMO with respect to organic semiconductor material.

(5+3+2)